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MCA
(SEM. I) THEORY EXAMINATION 2022-23
DISCRETE MATHEMATICS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

(a) State the Distributive and Associative laws of set theory.
(b) Write down the properties of Equivalence Relation.
(c) Define the Hasse diagram with example.
(d) What do you mean by Normal Form in Boolean algebra?
(e) Define the term Proposition.
(f) Negate the statement "*He is poor and laborious*"
(g) Define Monoid with example.
(h) Define the Commutative Ring with unity.
(i) Solve the recurrence relation: $a_n - 3\,a_{n-1} + 2a_{n-2} = 0$.
(j) Write down the properties of Generating function.

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) If $X = \{1,2,3\}, Y = \{p,q\}$ and $Z = \{a,b\}$ and the functions f and g are define as : $f : X \to Y$ be $f = \{(1,p),(2,p),(3,q)\}$, $g : Y \to Z$ be $g = \{(p,q),(q,b)\}$ then find fog and gof.
(b) Let L be the set of all factor of 12 and let '/' be the divisibility relation on L. Then show that (L, '/') is a lattice.
(c) Show that: $(p \leftrightarrow q) \wedge (q \leftrightarrow r) \longrightarrow (p \leftrightarrow r)$ is a Tautology.
(d) What do mean by Order of an element in a group? Find the order of each element of the multiplicative group g= {1,-1,i,-i}.
(e) Solve the recurrence $a_{n+2} - 4a_{n+1} + 4a_n = 2^n$

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) Define the function and explain the difference between function and relation with example
(b) For any set A and B, Prove that : $P(A \cap B) = P(A) \cap P(B)$.

4. Attempt any *one* part of the following: 10x1=10

(a) Define Modular Lattice. Also Prove that: Every Distributive lattice is Modular.

(b) Solve using K-map: $F(A, B, C, D) = \sum(0,1,2,3,4,5,6,7,8,9,11)$

5. Attempt any *one* part of the following: 10x1=10

(a) Show that s is a valid conclusion from the premises:
$p \rightarrow q, \quad p \rightarrow r, \quad \sim (q \wedge r) \quad and s \vee p.$

(b) If $K(x) : x \text{ is student}, M(x) : x \text{ is clever}, N(x) : x \text{ is successful}.$
Express the following using quantifiers:
- (i) There exists a student
- (ii) Some students are clever
- (iii) Some students are not successful.

6. Attempt any *one* part of the following: 10x1=10

(a) Define the permutation group. If A= {1, 2, 3, 4, 5} then find:
(1 3) 0 (2 4 5) 0 (2 3).

(b) Show that G= {0,1,2,3,4} is a cyclic group under addition modulo 5.

7. Attempt any *one* part of the following: 10x1=10

(a) Determine the numeric function corresponding to the following Generating function:
$A(Z) = \frac{7z^2}{(1-2z)(1+3Z)}$

(b) Prove by mathematical induction that $n^3 + 2n$ is divisible by 3 for each positive integer n.